The amoebot model is a popular model in the context of programmable matter, envisioning particles (or amoebots) as computational entities on the micro or nano level. Amoebots have only finite memory and move in a way inspired by amoeba. Kostitsyna et al. recently extended the amoebot model to include the aspect of fault tolerance by introducing particle crashes. A crash causes the memory of a particle to be reset and a crashed particle can detect that it has crashed and try to recover using its local information and communication capabilities. The authors propose an algorithm that solves the hexagon shape formation problem in that model if a finite number of crashes occur and a designated leader particle does not fail.

In this talk I will present a randomized algorithm that solves the leader election problem in the fault-tolerant amoebot model. A leader is elected with probability 1 in O(n^2) asynchronous rounds w.h.p. The algorithm is dynamic in the sense that even after the failure of a previously selected leader particle, it is guaranteed that a new unique leader will be determined. The algorithm can be extended in such a way that it can be superimposed on existing algorithms of the classical amoebot model, making them fault-tolerant. If a finite number of crashes occur during the execution of the algorithm and m particles are faulty after the last crash, then a non-faulty configuration is reached within O(mn) rounds w.h.p. after the last crash if the leader did not crash, or O(n^2) rounds w.h.p. if the leader crashed.

As another application, our algorithm also provides, as far as we know, the first solution to the leader election problem in the 3d amoebot model under the assumption of common chirality.